



348889

4500-45-4FDB

UNITED STATE ENVIRONMENTAL PROTECTION AGENCY

REGION V

77 W. Jackson Blvd.
Chicago, Illinois 60604

5HSM-5J

April 20, 1992

John Thorsen, Program Manager
Roy F. Weston, Inc.
Three Hawthorn Parkway, Suite 400
Vernon Hills, Illinois 60061

RECEIVED

APR 27 1992

ROY F. WESTON
VERNON HILLS, IL

Subject: Equipment Approvals for SSI, Sanyo Site, IN
Contract #68-W8-0089, WA # 45

Dear Mr. Thorsen:

This is in response to Mr. Glenn Brooks' April 6, 1992 request to seek EPA approval to rent special equipment to screen the areas where soil sampling at the Sanyo, IN site is proposed in order to determine the location of the ferrous ordinance.

Ms. Colleen Hart, Work Assignment Manager, Mr. James Ursic, Technical Support Section Geologist, and I have reviewed Mr. Brook's request, as well as the cost estimate submitted with the request to rent the special screening magnetometer for a period estimated to be three days. Mr. Ursic has provided some valuable comments as well as information on specific types of magnetometers that are available from U.S. sources that I am enclosing for your consideration. Weston shall make every effort to 1) secure the necessary equipment that will provide the safest system to perform the work based on knowledge of the ordinance at the site and 2) attempt to procure the equipment from an American source to avoid the duty charges identified in its April 6, 1992 letter.

I concur that the magnetometer equipment is necessary to screen the areas where soil sampling is proposed in order to determine the location of the ferrous ordinance at the subject site. Therefore, you are authorized to rent the magnetometer equipment for a period not to exceed 3 days, including shipping time and perform the screening test. Rental charges shall be charged to the SSI, Sanyo, IN budget and not the Program Management budget. The estimated cost for this equipment is as follows:

Equipment rental for 3 days	\$ 300.00
Duty (If unavailable from an American source)	600.00
Shipping/Delivery Charges	500.00
Total Estimated Cost	\$ 1,400.00

In addition, the estimated labor LOE and costs to complete the screening test at the Sanyo site is as follows:

Labor	22 LOE	\$1,145.00
Expenses		100.00
Total		\$1,245.00

The cost to complete this screening test shall be charged to the SSI, Sanyo, IN budget and the actual costs for this screening exercise shall be reflected in the monthly project report narrative as well as any future work plan revision requests submitted for WA #45.

If you have any questions, please contact me at (312) 886-5496.

Sincerely,

A handwritten signature in cursive script, appearing to read "Stephen Nathan", written in black ink.

Stephen Nathan
Project Officer

Enclosures

cc: B. Manzke, Contracting Officer, 5MCC-10J
C. Hart, Work Assignment Manager, 5HS-6J

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: April 14, 1992

SUBJECT: Buried Munitions at Sanyo Site
Richmond, Indiana

FROM: James R. Ursic, Geologist
Technical Support Section

TO: Colleen Hart, WAM

I have reviewed Weston's request to lease a Scintrex V-92 magnetometer for detecting munitions at the Sanyo Site located in Richmond, Indiana.

During my review of the Sanyo request I spoke with Glenn Brooks, the person who initiated the V-92 lease request. I have worked with Mr. Brooks in the past and found him to be knowledgeable in the field of geophysics. Mr. Brooks said that he has used the V-92 in the past to locate buried ordinance.

Locating buried munitions is obviously a dangerous situation. Not only are most munitions sensitive to contact, but several types of munitions have a variety of techniques which can trigger their detonation. Some types of detonators can be actuated by an electrical field, magnetic, heat and seismic disturbances. In addition, some types of munitions are all plastic and cannot be found with any type of metal detectors.

It is very important to determine, if possible, exactly what type of munitions and detonators are involved and proceed appropriately.

If metallic munitions are known to be in the area, a proton procession magnetometer (mag) and fluxgate mag would be capable of locating anomalies. However, the proton mag intermittently produces a small electrical field to temporally orient the proton fluid which initiates the sensing cycle. Such a electrical field could interfere with certain detonators. Resolution of the instrument is from 0.1 to 1 gamma depending on the model used.

Fluxgate mags can measure changes in the magnetic field (anomalies) without establishing an electrical field prior to taking a reading. However, cycle time of the fluxgate mags requires several seconds between each reading. Fluxgate mags are the most inexpensive type of mag to buy or lease. Resolution of the instrument is 1 gamma.

The V-92 uses a cesium optical vapor sensor system. Radio frequencies (RF) are part of the V-92 system, but I was told by

Scintrex that the RF is not as strong as the proton mag signals. Sensitivity of the instrument is from 0.1 to 1 gamma depending on the model used.

The sampling rate for the proton and fluxgate mags are much less than the V-92 which is basically a continuously sensing device. Differences in sampling rates of the mags will effect how much time is need to complete a survey. If small areas are to be scanned, no real advantages would be gained with the V-92. Large areas would be advantageous to use the V-92.

In conclusion, the type of mag to be used should be determined by the type of target to be located. If RF signals are not a concern, ground penetrating radar could be another alternative for locating objects. However if specific information about detonators are unknown, the safest system should be used.

If it is determined that the V-92 is to be used, the instrument should be obtained through Scintrex's U.S. office to by-pass custom fees etc. Currently Weston is planning to use Scintrex's Canadian office (not the U.S. office) if the V-92 is to be used.

Scintrex's U.S. office is located at:

Scintrex U.S.A. c/o
Ellen Westoff or Tom Hasek
5450 Riggins Court
Unit #3
Reno, Nevada 98502
Telephone: (702) 829-1134

If possible, I would like to be present during the time of the mag survey to oversee the operations at the Sanyo Site. Please let me know if and when this would be possible.

EXPLOSIVE ORDNANCE DETECTOR MAGNETOMETER/V-92



FEATURES:

- CONTINUOUS SENSING
- AUTOMATIC DISPLAY UPDATES
11 TIMES/SECOND
- CONTINUOUS AUDIO OUTPUT OF
7 Hz/GAMMA
- OPTIONS OF 3.5 Hz/GAMMA AND
1.75 Hz/GAMMA
- SENSOR SEALED TO 30 FEET OF
WATER IMMERSION
- CAN OPERATE ON 200 FEET OF
CABLE
- SENSOR TOLERANT OF HIGH
FIELD GRADIENTS
- ONLY AUDIO ADJUSTMENTS ARE
NEEDED
- RUGGED CONSTRUCTION

The V-92 Explosive Ordnance Detector (EOD) provides the capability of detecting buried ferrous ordnance with a low false alarm rate. It is designed for searching areas at a walking speed. The V-92 continuously reads the earth's magnetic field; buried ordnance produces an anomaly in the field and will result in a change of both the audio output frequency and the numerical output. The V-92 is able to detect 500 lb. bombs at depths of 15 feet.

SCINTREX

222 Snidercroft Road
Concord Ontario Canada
L4K 1R5

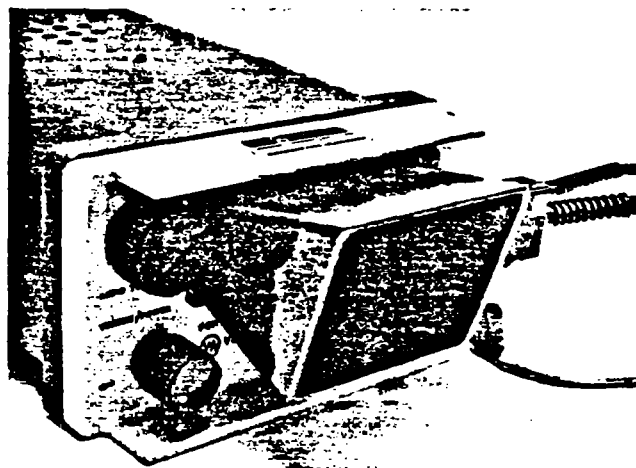
Telephone: (416) 669-2280
Cable: Geoscint Toronto
Telex: 06-964570

*Blair
Walker*

204
7-84

BENEFITS

- Allows "sweeping action"
- Rapid coverage of territory
- Direct measure of field in gammas
- Real-time indication of field changes
- Sensitivity adjustable for expected targets
- Works in watery environments
- Can be used underwater
- Weather-proof
- Bore-hole applications
- Able to operate near large disturbances
- Easy to learn
- Simple to operate
- Reliable
- Long working life



SPECIFICATIONS

Range	20,000–100,000 gammas	Tone Frequency	Approximately 7 pulses per second to 10 kHz manually set
Sensor Orientation	Optimum angle 45° between Sensor Head axis and total magnetic field vector. Active zone of operation 15° –75° and 105° –165°	Audio Information	Continuous and instantaneous. Approximately 7 Hz change in tone per 1 gamma change in total field intensity.
Sensitivity	± 1 gamma	Power Supply	Rechargeable batteries
Visual Readout	5 digit, 0.3 inch high 7-segment Incandescent display	Operating Time	6 hours under moderate conditions 4 hours at –35° C with batteries worn under the outer garment
Measurement Time	Approximately 45 ms	Operating Environment	–35° C to +50° C Sensor: 30 feet of water immersion Readout: 3 feet of water immersion
Measurement Rate	About 11 times per second	Storage Temperature	–40° +55° C
Display Time	0.54 second (Optional—0.27, 0.36, 0.45, 0.63, 0.71 sec)		
Audio Output	Via speaker or headphones		

DIMENSIONS AND WEIGHT

Sensor—staff:	50 inches (1270 mm)	Battery Charger:	8 x 4.75 x 6 inches (203 mm x 121 mm x 153 mm) 6.5 pounds (3 kg)
Readout:	7 x 4 x 10 inches (178 mm x 102 mm x 250 mm) 5.75 pounds (2.6 kg)	Packaging Option	1. Carrying Case 43 x 25 x 11 inches (1093 mm x 625 mm x 280 mm) Approximately 65 pounds (26 kg)
Battery Pack:	14 x 6 x 2 inches (356 mm x 153 mm x 59 mm) 11 pounds (5 kg)	Packaging Option	2. Has a systems case and accessories case (for dimensions and weight data please inquire VCI for further details)

DW GEOPHYSICAL SERVICES, INC.
 418 V. St. 1520 South Hill, Bldg. 8
 Salt Lake City, Utah 84114
 (801) 972-4004

Geophysical and Geochemical
 Instrumentation and Services

SCINTREX

records
11x Sec
\$ 20750

Senses a field $\pm 10'$ wide.



V-90, V-91

PORTABLE
OPTICALLY PUMPED
MAGNETOMETERS

The V-90 and V-91 Portable Magnetometers measure the magnitude of magnetic field intensity within the range of 20,000-100,000 gammas (1 gamma = 10^{-5} Oersted). The measurements are taken at the rate of 11 times per second and displayed in the form of a 6 digit number by a 7 segment visual readout. The display time of the readout is limited by human response and is normally 0.54 sec (0.27, 0.36, 0.45, 0.63 or 0.71 sec are optional). The sensitivity is ± 0.1 gamma. The readout is tuned automatically by auto-ranging circuitry. In addition to the visual display, an audio frequency is provided derived from the difference of the Larmor frequency (proportional to the magnetic field intensity) and a reference frequency selected by auto-ranging circuitry. The audio output changes its frequency at 7 Hz per gamma rate. The pitch of the tone is adjustable manually to suit the operator. The audio output allows the operator to perform a rapid search for localized magnetic anomalies such as those associated with buried unexploded ordnance, archeological targets, buried or submerged pipelines etc.

The V-91 magnetometer also provides analog and digital outputs. Two simultaneous analog outputs provide 100 mV FSD and low sensitivity (100 gamma and 1000 gamma) or high sensitivity (10 gamma and 100 gamma) can be selected. The digital output is in the form of BCD.

The instrument consists of:

a) The OPTICALLY PUMPED SENSOR is optically monitored and of self oscillating construction. This technology is a proprietary technique. The sensor generates a continuous output in the form sinusoidal waveform whose frequency is proportional to the total field intensity with the constant of proportionality of 3.4986 Hz/gamma. The limiting sensitivity of the sensor is ± 0.005 gamma, the absolute accuracy is ± 0.5 gamma. The sensor exhibits a high gradient tolerance of more than 50,000 gammas/meter and will follow ac changes in the magnetic field of up to 20 kHz provided the changes are small with respect to the total field value measured. The Larmor frequency generated by the sensor is present as long as the sensor is oriented $45^\circ \pm 35^\circ$ with respect to the magnetic field vector.

b) The READOUT UNIT uses as an input the Larmor frequency from the sensor connected to the Readout by a single coaxial cable (max length of 200 feet). The Larmor frequency is subtracted from a reference frequency determined automatically by an auto-ranging circuit in the Readout. No manual tuning is required. The difference frequency is then multiplied up and counted. This method allows rapid and accurate counting even when the input signal-to-noise is low. The difference frequency is then subtracted from a manually controlled ("Audio Tune") frequency source to give an audio output. The volume of the audio output is adjustable via a "Power Off/Volume" potentiometer. The Readout Unit contains a speaker which can be disconnected by plugging in of a headphone into "Phone" connector.

The Readout Unit is designed to use common parts with the Readout Unit of the Portable Gradiometer/Variometer, V-100 and V-101. Thus, upon request, the instrument can be upgraded to a Gradiometer/Variometer.

c) The BATTERY BELT consists of five rechargeable batteries and will power the unit for a minimum of 4 hours under most adverse conditions. The typical operating time is 6 hours.

d) The BATTERY CHARGER operates from a 12 V car battery or a 115 Vac power supply and can recharge up to 3 Battery Belts at the same time.

The Portable Magnetometer/Variometer produces a continuous, audible indication of magnetic anomalies. The search for local



disturbances is thus very rapid in contrast with portable proton or flux-gate instruments which require the operator to stop, take a reading and compare it with the previous one. With very little experience, one can learn to recognize anomaly signatures and estimate such things as depth, distance and mass of magnetic material. The very high sensitivity means that even very subtle magnetic anomalies can be detected and any limitations on the search are then related to the environment, not the instrument resolution.

Applications:

Among the many applications are pipeline and cable location, salvage operations, recovery of buried historical items and location of survey markers. Publications are available detailing ARCHAEOLOGICAL exploration for buried walls, kiln-fired clay and pottery, tombs and stone statues. Magnetometers have been used to locate buried or submerged cars and planes and in the recovery of legal evidence. Numerous military applications have been demonstrated involving detection of munitions, booby traps, mines, supplies and tunnels. The location of magnetically tagged objects or animal specimens has been proven practical. Qualitative and quantitative geological reconnaissance is both rapid and practical if one suspects subtle near-surface contrasts in magnetic susceptibility caused by dikes, mineralized zones, placer deposits, intrusions, shallow faults and other geological formations which may exhibit magnetic variations.

Special packaging is available for UNDERWATER use and VEHICLE mounting.

V-90, V-91

V-90 Portable Magnetometer Specifications

Range	20,000-100,000 gammas
Sensor Orientation	Optimum angle 45° between Sensor Head axis and total magnetic field vector. Active zone of operation 15° -75° and 105° -165°
Sensitivity	± 0.1 gamma
Visual Readout	8-digit, 0.3 inch high 7-segment incandescent display
Measurement Time	Approximately 45 ms
Measurement Rate	About 11 times per second
Display Time	0.54 second (optional - 0.27, 0.36, 0.45, 0.63, 0.71 sec)
Audio Readout	Via speaker or headphones
Tone Frequency	Approximately 7 pulses per second to 10 kHz manually set
Audio Information	Continuous and instantaneous Approximately 7 Hz change in tone per 1 gamma change in total field intensity
Power Supply	five rechargeable batteries 30 V nominal 6 A hours
Operating Time	10-12 hours under moderate conditions 8 hours at 0° C
Operating Environment	-35° C to +50° C Sensor: 30 feet of water immersion Readout: 3 feet of water immersion
Storage Temperature	-40° - +55° C
Dimensions & Weight	
Sensor-Staff	50 inches long fully extended 4.0 pounds
Readout	7 x 4 x 10 inches 4.6 pounds
Battery Pack	14 x 6 x 2 inches 7.5 pounds
Battery Charger	8 x 4.3/4 x 6 inches 9 pounds
Carrying Case	43 x 25 x 11 inches Approx. 65 pounds gross

V-91 Portable Recording Magnetometer Specifications

Analog Readout	2-channel voltage outputs directly proportional to total field intensity variations	
Analog Readout Ranges	Switch selectable Low/High Resolution Range Each range position selects two concurrent channel outputs	
Low Resolution Range	Channel 1 990 gammas F.S.	Channel 2 99 gammas F.S.
or		
High Resolution Range	99 gammas F.S.	9.9 gammas F.S.
Analog Recorder		
Options	HP 7100B	10 inch dual channel chart recorder
	HP 7155B	5 inch single-channel, battery powered chart recorder
	HP 680	5 inch single-channel chart recorder

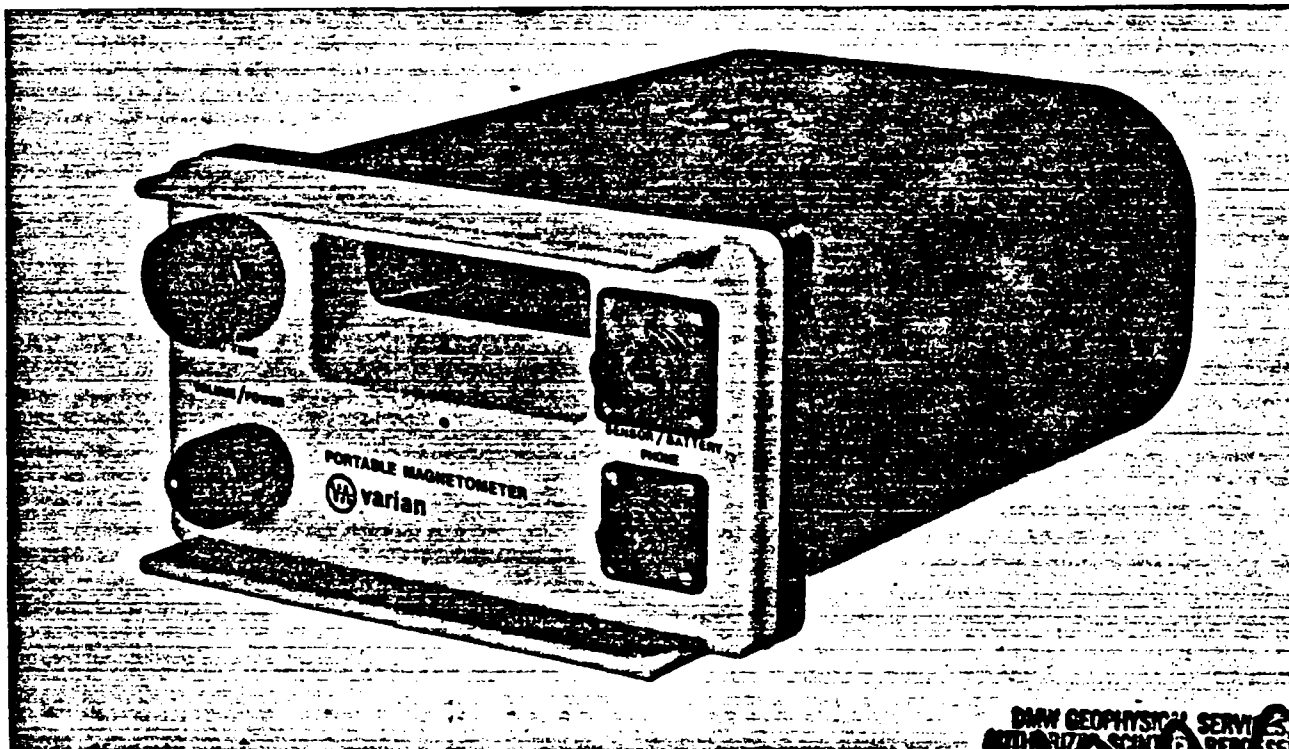
All specifications for V-90 also apply to V-91.

- FAST SAMPLING—11 times per sec
- HIGH SENSITIVITY—±0.1 gamma
- PORTABLE
- AUTO RANGING
- AUDIO READOUT
- LOW HEADING ERROR

222 Snidercroft Road
Concord, Ontario, Canada
L4K 1B5

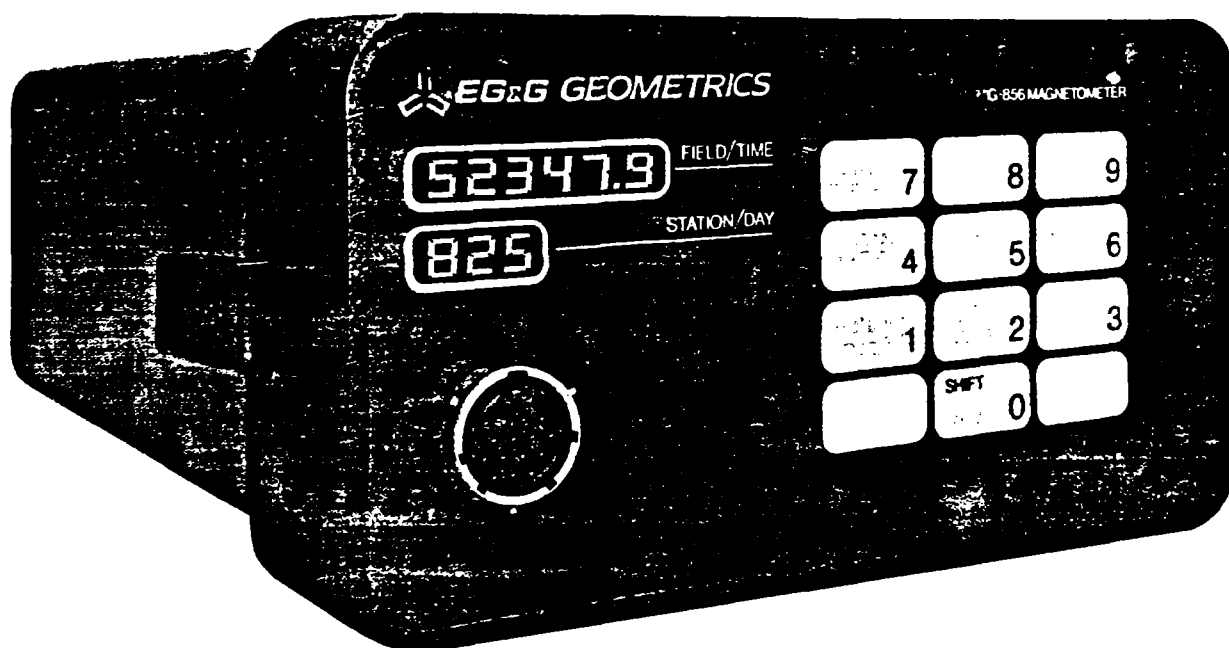
Telephone: (416) 669-2280
Cable: Geoscint Toronto
Telex: 06-964570

Geophysical and Geochemical
Instrumentation and Services



DAW GEOPHYSICAL SERVICES, INC.
AUTHORITY TO SELL REPRESENTATIVE
401 EAST 13TH STREET
SALT LAKE CITY, UT 84104
801-472-4334

Portable Proton Magnetometer Model G-856A



Features

- High resolution — accurate to within 0.1 gamma
- Easy operation — automatically tunes, reads, and displays total field at the touch of a button. Beeper/annunciator sounds when keyboard is used
- Expandable memory — stores and accesses up to 5,700 field readings or 12,000 base station readings
- Convenient data recall — stored readings instantly available, including time, date, and station number
- Automatic data processing — compatible with various small computers for on-line processing, including correction for time variations, averaging, filtering and drawing profiles
- Versatile — portable search and survey magnetometer, gradiometer, or base station recorder
- Works anywhere — unaffected by orientation or environment. Sealed, scratch-resistant keyboard is weatherproof.
- Easy to carry — console weighs only 6 pounds with D-cell batteries installed
- Comes complete — supplied with sensor, staff, chest harness, batteries, carrying/shipping case, and manuals



Accessories

The G-856 comes complete with a full set of field accessories: sensor, batteries, staff, chest harness, carrying/shipping case and interpretation manual.

Specifications

DISPLAY: Six digit display of magnetic field to resolution of 0.1 gamma or time to nearest second. Additional three-digit display of station, day of year, line number, battery voltage or signal strength.

RESOLUTION: Typically 0.1 gamma in average conditions. May degrade to lower resolution in weak fields, noisy conditions or high gradients.

ACCURACY: One-half gamma, limited by remnant magnetism in sensor and crystal oscillator accuracy.

CLOCK: Julian clock with stability of 5 seconds per month at room temperature and 5 seconds per day over the temperature range of -20 to $+50$ degrees Celsius.

TUNING: Automatically tunes for maximum signal strength after each reading. Tuning may be manually adjusted to compensate for high gradient shifts and for changes in length of sensor cable. Tuning range covers 20 to 90 kilogammas.

GRADIENT TOLERANCE: Tolerates gradients to 5000 gammas/meter. When high gradients truncate count interval, maintains partial reading to accuracy consistent with data. Sounds audio alarm in high gradients or when signal is weak.

CYCLE TIME: Complete field measurement in three seconds in normal operation. Internal switch for faster cycle (1.5 seconds) at reduced resolution or slower cycle for improved signal. Auto-cycle time for base station operation can be reduced to 2 seconds.

MANUAL READ: Takes reading on command. Will store data in memory on command at operator's discretion.

SELF-CYCLE: Internal switch will cause the instrument to self-cycle, storing automatically, for time dependent measurements. Available intervals are 4 to 999 seconds in one-second increments selected by push buttons.

MEMORY: In portable mode stores over 1,400 readings with time of reading and station number. In base station mode, stores over 2,500 readings with Julian date and time of reading. Model

G-856X with optional extended memory will store 5,700 readings taken in the portable mode and 12,000 readings taken in the base station mode.

OUTPUT: Standard RS-232 or byte parallel, character serial BCD. Selection of baud rates includes 110, 150, 300, 600, 1200, 2400, 4800, 9600.

INPUTS: Will accept an external sample command and will synchronize reading with another G-856.

BEEPER/ANNUNCIATOR: Sounds once when a key is touched, three times after data have been transferred through RS-232 port, and five times in high gradients or when signal is weak.

SPECIAL FUNCTIONS: An internal switch allows lengthening or shortening polarization time and count time to improve performance in marginal areas, improve resolution, shorten cycle time, increase battery life, and to perform a 3-point average.

PHYSICAL: Instrument console: 7 x 10½ x 3½ inches (18 x 27 x 9 cm); 6 lbs (2.7 kg).

Sensor: 3½ x 5 inches (9 x 13 cm); 4 lbs (1.8 kg).

Staff: 1 inch x 8 feet (3 cm x 2.5 m); 2 lbs (1 kg).

ENVIRONMENTAL: Meets specifications from 0 to 40 degrees Celsius. Operates satisfactorily from -20 to 50 degrees Celsius. Weatherproof.

POWER: Operates from 8 D-cell flashlight batteries (or 12 volts external power). May be operated at 18 volts external power to improve resolution. Power failure or replacement of batteries will not cause loss of data stored in memory. Battery voltage measured and displayed during polarization.

STANDARD ACCESSORIES: Sensor, Staff, Chest Harness, Two sets of Batteries, Operating Manual, Applications Manual for Portable Magnetometers.

OPTIONAL ACCESSORIES: Gradiometer Configuration, RS-232 Interface Cable, Cold Weather Battery Belt, Digital Tape Recorder with Interface Cables.



EG&G GEOMETRICS

395 Java Drive
Sunnyvale, California 94089, U.S.A.
Tel: (408) 734-4616
Telex: 357-435



EG&G GEOMETRICS

International Corporation (GIC)
18 Gertrude Street
Arncliffe, 2205, Australia
Tel: 597-4544 Telex: AA22624

OMNI PLUS VLF/Magnetometer System



Major Benefits of the OMNI PLUS

- Combined VLF/Magnetometer/Gradiometer System
- No Orientation Required
- Three VLF Magnetic Parameters Recorded
- Automatic Calculation of Fraser Filter
- Calculation of Ellipticity
- Automatic Correction of Primary Field Variations
- Measurement of VLF Electric Field



Specifications*

Frequency Tuning Range	15 to 30 kHz, with bandwidth of 150 Hz; tuning range accommodates new Puerto Rico station at 28.5 kHz
Transmitting Stations Measured	Up to 3 stations can be automatically measured at any given grid location within frequency tuning range
Recorded VLF Magnetic Parameters	Total field strength, total dip, vertical quadrature (or alternately, horizontal amplitude)
Standard Memory Capacity	800 combined VLF magnetic and VLF electric measurements as well as gradiometer and magnetometer readings
Display	Custom designed, ruggedized liquid crystal display with built-in heater and an operating temperature range from -40°C to $+55^{\circ}\text{C}$. The display contains six numeric digits, decimal point, battery status monitor, signal strength status monitor and function descriptors.
RS232C Serial I/O Interface	2400 baud rate, 8 data bits, 2 stop bits, no parity
Test Mode	A. Diagnostic Testing (data and programmable memory) B. Self Test (hardware)
Sensor Head	Contains 3 orthogonally mounted coils with automatic tilt compensation
Operating Environmental Range	-40°C to $+55^{\circ}\text{C}$; 0 – 100% relative humidity; Weatherproof
Power Supply	Non-magnetic rechargeable sealed lead-acid 18V DC battery cartridge or belt; 18V DC disposable battery belt; 12V DC external power source for base station operation only.
Weights and Dimensions	
Instrument Console	2.8 kg, 128 x 150 x 250 mm
Sensor Head	2.1 kg, 130 dia. x 130 mm
VLF Electronics Module	1.1 kg, 40 x 150 x 250 mm
Lead Acid Battery Cartridge	1.8 kg, 235 x 105 x 90 mm
Lead Acid Battery Belt	1.8 kg, 540 x 100 x 40 mm
Disposable Battery Belt	1.2 kg, 540 x 100 x 40 mm

*Preliminary

EDA Instruments Inc.,
4 Thorncliffe Park Drive,
Toronto, Ontario
Canada M4H 1H1
Telex: 06 23222 EDA TOR,
Cables: Instruments Toronto
(416) 425-7800

In USA,
EDA Instruments Inc.,
5151 Ward Road,
Wheat Ridge, Colorado
U.S.A. 80033
(303) 422-9112

Printed in Canada

8200

SCINTREX MP-3 Proton Magnetometers and GS-2/MP-4

option - lead acid battery 16k memory 1. once every 2 sec
option - gradient



Technical Description of the MP-3 Proton Magnetometer

temperatures above 0°C. Weight is 0.9 kg. At 25°C gives 10,000 total field or 5000 total field gradient readings.

Rechargeable Battery Pack and Charger

Includes battery holder, 6 rechargeable, non-magnetic, sealed lead-acid batteries and charger for installation on console. Best for high sensitivity total field measurements, all gradient measurements and operation below 0°C. Pack weighs 1.3 kg. Nominal capacity is 2.5 Ampere hours. At 25°C gives 7000 total field or 3500 total gradient readings. Charger specifications are: 140 x 95 x 65 mm, 115/230 V AC; 50/60 Hz; 20 VA, overload protected.

Heavy Duty Rechargeable Battery Pack

Includes heavy duty rechargeable batteries installed in a console with a built-in charger. Used for rapid cycling base station or mobile applications. Total weight is 7.6 kg. Nominal capacity is 12.5 Ampere hours. Dimensions are 240 x 90 x 240 mm. Power requirements: 115/230 V AC; 50/60 Hz; 50 VA. Overload protected.

Low Temperature Battery Extender Kit

Comprises a cover for the bottom of the instrument console, a battery pack cover, a waist belt and a battery cable. Slots on the battery pack cover permit belt mounting next to the operator's body for warmth.

Optional Accessories

Language Options

In addition to English, a second language using Latin characters can replace French.

RS-232 Cable and Adaptor

Includes a special RS-232 data transfer cable and MP-3 to RS-232 cable adaptor. Used for communicating between the MP-3 and peripheral devices including a second MP-3 or IGS-2/MP-4 for diurnal corrections.

Minor Spare Parts Kit

Includes 2 keyboard diaphragms and two fuses.

Carrying Cases

A variety of carrying cases are available to suit different combinations of console and sensor options.

Display Heater

Required for cold weather operation. Powered by main batteries, thermostatically controlled to turn off above -20°C.

MP-3/4 Proton Magnetometer

Function Tester

When connected between the console and sensor, applies a signal to test the polarizing circuit, the coil and the signal processing circuitry. Switch selectable magnetic field simulation at 22,500; 30,000; 45,000; 60,000 and 90,000 nT.

Peripheral Devices

Scintrex is prepared to recommend or supply digital printers, modems, cassette tape recorders, analog recorders and microcomputers with software.

Applications Software

Scintrex supplies fully documented software written for the IBM PC computer and certain other microcomputers which use the MS-DOS operating system. This software is designed to permit: 1) archiving of data, 2) processing of magnetic data and 3) profile and contour outputs on digital printers.

Memory Expansion Options

Memory Expansion I

Memory can be added on an existing board to complement the 16K RAM Standard Memory. This can be done in up to six 8K RAM increments to raise system memory to a total of 64K RAM. Each 16K RAM increment holds as many readings as the Standard Memory.

Memory Expansion II

An additional board is required on which an additional sixteen 8K RAM groups can be installed to bring the system total memory to 192K RAM. Each 16K RAM increment holds as many readings as the Standard Memory.

SCINTREX

DMW GEOPHYSICAL SERVICES, INC.
103 WEST 810 SOUTH JN. E.
SALT LAKE CITY, UTAH 84144
(801) 972-4004

Geophysical and Geochemical
Instrumentation and Services



V-100 and V-101 Portable Gradiometer/Magnetometers use two optically-pumped sensors to determine the magnitude of the magnetic field intensity at two points spaced 2 meters apart. By subtracting the two measured values, a gradient of the total field intensity can be determined. The sensitivity of the gradient measurement is ± 0.1 gamma/2 meters (1 Oersted = 10^5 gammas) and the range is ± 9000 gammas/2 meters.

These instruments are also designed to work in so-called variometric mode whereby one sensor is stationary while the other, connected via a single coaxial cable, is used as a mobile sensor. In this mode a very detailed survey of an area may be conducted with the results being independent of time-varying components of the earth's magnetic field (diurnal changes, micropulsations). The sensitivity in this mode is ± 0.1 gamma while the range is ± 9000 gammas.

Each of the two sensors can also be used for the total field measurements. In this mode of operation, the magnitude of the magnetic field intensity can be measured over the range of 20,000 to 100,000 gammas. This range enables measurements to be conducted of the earth's magnetic field in any area in the world. The sensitivity of the measurements is ± 0.1 gamma and the absolute accuracy is ± 0.5 gamma. The two sensors, normally assembled in one assembly for gradiometer operation, can be physically separated and one disconnected totally if the total field measurements only are desired.

In all three modes of operation (Gradiometer/Variometer/Total Field Magnetometer) the results are displayed in the form of a 6 digit number by a 7 segment display. The display is updated 2 times per second. An incandescent display is used to facilitate good visibility when illuminated by sunlight.

In addition to the visual display, an audio output is available whose frequency is proportional to the measured value of the gradient or the total field. The sensitivity of the audio output is 7 Hz/gamma in the total field mode and 7 Hz per 1 gamma/2 meters in the gradiometric mode. The audio display permits a rapid survey for localized magnetic anomalies such as those observed in ordnance location work, in archaeological applications or in pipeline or cable location work.

The visual display update time is limited by the human response. The instrument takes measurements at the rate of 11 times per second and each of the measurements takes 0.045 seconds.

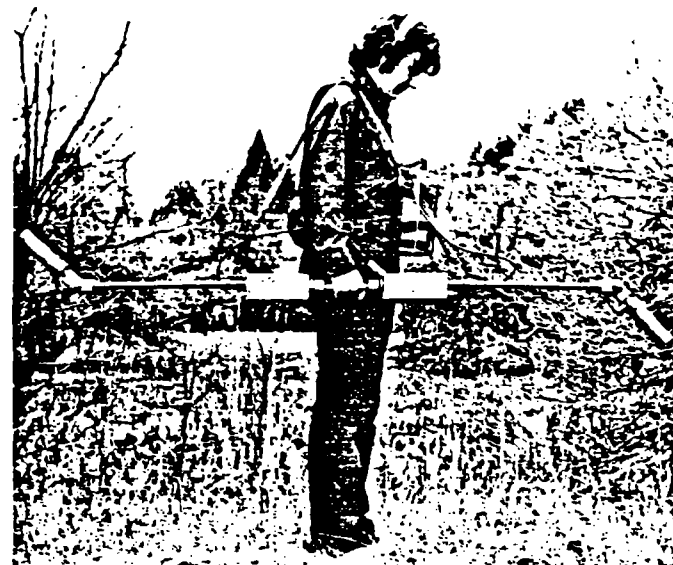
The V-101 instrument also provides two simultaneous analog outputs as well as digital BCD information. Neither analog nor digital outputs are provided in V-100 system. The V-101 can serve as Station Magnetometer or Gradiometer.

The instrument consists of:

a) Two OPTICALLY PUMPED SENSORS are optically monitored and of self-oscillating construction. This technology is a proprietary technique developed by Varian. The sensor generates a continuous output in the form sinusoidal waveform whose frequency is proportional to the total field intensity with the constant of proportionality of 3.4986 Hz/gamma. The limiting sensitivity of the sensor is ± 0.005 gamma, the absolute accuracy is ± 0.5 gamma. The sensor exhibits a high gradient tolerance of more than 50,000 gammas/meter and will follow ac changes in the magnetic field of up to 20 kHz provided the changes are small with respect to the total field value measured. The Larmor frequency generated by the sensor is present as long as the sensor is oriented $45^\circ \pm 35^\circ$ with respect to the magnetic field vector.

b) The READOUT UNIT uses as an input the Larmor frequency from the two sensors each of which is connected by a single coaxial cable. The unit can work in:

1. Differential mode - the two Larmor frequencies are subtracted from each other thus providing either a gradient measurement or a variometric measurement.



2. Total field mode - frequency from one of the sensors (selectable) is subtracted from a synthesizer frequency and counted.

In both modes the difference frequency is fed into an auto-ranging counter and displayed in gammas (total field mode, variometer mode) or in gammas per 2 meters (gradiometer mode). In addition an audio frequency proportional to the result of the frequency subtraction is generated. This frequency can be offset in the range of 10 Hz to 10 kHz by "Audio Tune" potentiometers so that the pitch is comfortable for the operator. The volume of the audio is adjustable via a "Power Off/Volume" potentiometer. The Readout Unit contains a speaker which can be disconnected by plugging in of a headphone into "Phone" connector.

c) The BATTERY BELT consists of five rechargeable batteries and will power the unit for a minimum of 4 hours under most adverse conditions. The typical operating time is 6 hours.

d) The BATTERY CHARGER operates from a 12 V car battery or a 115 Vac power supply, and can recharge up to two battery belts at the same time.

Applications

Among the many applications are pipeline and cable location, salvage operations, recovery of buried historical items and location of survey markers. Publications are available detailing ARCHAEOLOGICAL exploration for buried walls, kiln-fired clay and pottery, tombs and stone statues. Magnetometers have been used to locate buried or submerged cars and planes and in the recovery of legal evidence.

Numerous military applications have been demonstrated involving detection of munitions, booby traps, mines, supplies and tunnels. The location of magnetically tagged objects or animal specimens has been proven practical. Qualitative and quantitative geological reconnaissance is both rapid and practical if one suspects subtle near-surface contrasts in magnetic susceptibility caused by dikes, mineralized zones, placer deposits, intrusions, shallow faults and other geological formations which may exhibit magnetic variations.

V-101 with its Digital and Analog Outputs is an inexpensive, high-sensitivity, base station or observatory.

Special packaging is available for UNDERWATER use and VEHICLE mounting.

V-100, V-101

V-100 Portable Gradiometer/Variometer/Magnetometer Specifications

Operating Modes	Total field intensity, Sensor A or Sensor B Gradient, B-A
Operating Range	Total field 20,000-100,000 gammas Gradient $\pm 9,000$ gammas
Sensor Orientation	Optimum angle 45° between Sensor Head axis and total magnetic field vector. Active zone of operation each Sensor 15°-75°, 105°-165°, 195°-255°, 285°-345°
Sensitivity	± 0.1 gamma
Visual Readout	6-digit, 0.3 inch high 7-segment incandescent display
Measurement Time	45 milliseconds
Measurement Rate	11 times per second
Display Time	0.54 second (optional - 0.27, 0.36, 0.45, 0.71 second)
Audio Readout	Via speaker or headphones
Tone Frequency	7 pulses per second to 10 kHz/Manually set
Audio Information	Continuous and instantaneous 7 Hz change in tone frequency per 1 gamma change in total field intensity or per 1 gamma change in gradient
Power Supply	5 rechargeable batteries 30 V nominal (6 V in parallel for charging) 6 A hours
Operating Time	6 hours under moderate conditions 4 hours at 0°C
Operating Environment	-35 to +50°C Sensors: 30 feet of water immersion Readout: 3 feet of water immersion
Storage Temperature	-40° +55°C
Dimensions & Weight Sensors-Staff Assembly	84 inches long fully extended, 10 pounds
Single- Sensor Staff Assembly	46 inches long fully extended 4.8 pounds
Readout	7 x 4 x 10 inches 14 pounds
Battery Pack	22 x 5 x 3 inches 4.8 pounds
Battery Charger	8 x 4.75 x 6 inches 9 pounds
Carrying Case	43 x 25 x 11 inches Approx. 80 pounds gross

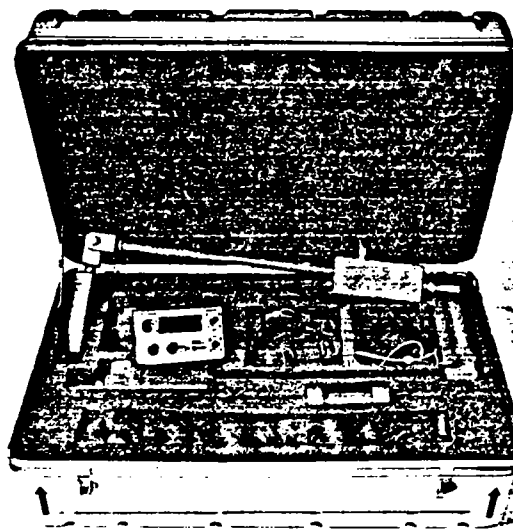
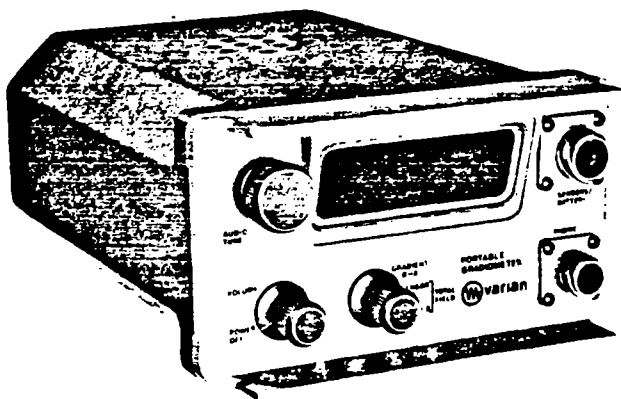
V-101 Portable Recording Gradiometer/Variometer/Magnetometer Specifications

Analog Readout	Two channel voltage outputs directly proportional to total field intensity (in magnetometer mode) or to gradient or variance (in gradiometer and variometer mode respectively).	
Analog Readout Ranges	Switch-selectable Low/High Resolution Ranges. Each range position selects two simultaneous channel outputs:	
Low Resolution Range	Channel 7 990 gamma F.S. or 990 gamma/2 m F.S.	Channel 2 99 gamma F.S. or 99 gamma/2 m F.S.
High Resolution Range	99 gamma F.S. or 99 gamma/2 m F.S.	9.9 gamma F.S. or 9.9 gamma/2 m F.S.
Analog Recorder		
Options	H-P 680 5-inch single-channel chart recorder. H-P 7100B 10-inch dual channel chart recorder H-P 7155B 5-inch single-channel battery-powered chart recorder	

- FAST SAMPLING—11 times per sec
- HIGH SENSITIVITY— ± 0.1 gamma
- PORTABLE
- AUTO RANGING
- LOW HEADING ERROR

DMW GEOPHYSICAL SERVICES, INC.
1018 WEST 420 SOUTH, UNIT B
SALT LAKE CITY, UTAH 84104
(801) 972-4604

Geophysical and Geochemical
Instrumentation and Services



SCINTREX MF-2-100 Portable Fluxgate Magnetometer

Function

The MF-2-100 is the latest in a successful line of portable analogue reading fluxgate magnetometers by Scintrex.

Hand-held measurements can be made with an accuracy of a few gammas while precision of one gamma is possible using a portable, lightweight tripod.

The internal sensor provides vertical component measurements for normal field surveys while a remote sensor is available as an accessory for horizontal or other component measurements, or for study of the magnetic properties of rocks.

Features

Compact, internal sensor package permits rapid field surveys

Rugged and lightweight for portable field use

Self leveling and orientation insensitive sensor measures vertical component of magnetic field

High sensitivity in all field strengths

Low power requirements permit long life of standard dry cell or optional rechargeable batteries

Will measure accurately anywhere, even in the presence of steep magnetic gradients

Direct analogue readout can be recorded on any analogue recorder for base station use

Can be used for measurements of magnetic susceptibility and remanance by bringing samples near to sensor

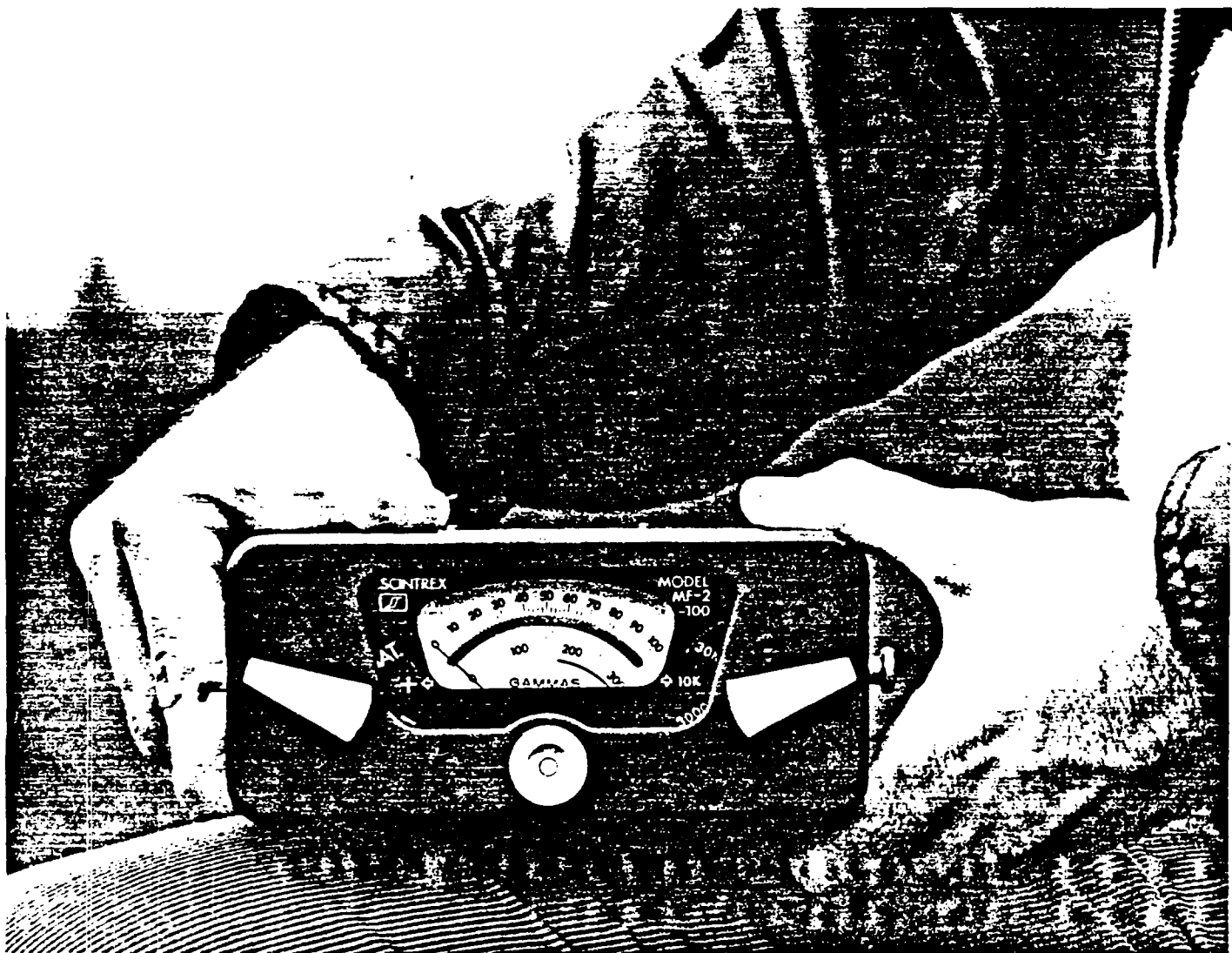
State-of-the-art solid state circuitry ensures very low temperature drift

Easily operated in low magnetic fields such as near the equator

Rugged, all metal case for long life

Over 200,000 gamma range

Proven high standard of reliability



Technical Description of the MF-2-100 Portable Fluxgate Magnetometer



Meter Ranges	From 100 gammas to 100,000 gammas full scale in seven switch selectable steps, reversible in polarity
Measuring Range	-100,000 +100,000 gammas relative to a given zero field level
Latitude Bucking (zero gamma level adjustment)	Range is 100,000 gammas in 9 steps of 10,000 gammas plus fine control of 0 to 10,000 gammas by ten turn potentiometer Northern Hemisphere -20,000 to +80,000 gammas absolute Southern Hemisphere -20,000 to +80,000 gammas absolute
Operating Temperature Range	-40° to +50°C
Resolution	± 0.5% of full scale on all meter ranges
Perming	Less than 1 gamma/oersted
Meter	Taut band suspension 100 scale is 53 mm long with 50 divisions 300 scale is 48 mm long with 60 divisions
Noise Level	Less than 1 gamma peak to peak from DC to 3 Hz
Temperature Coefficient	Less than 1 gamma/°C
Electrical Response	3 db down from DC to 3 Hz on most sensitive range
Recording Output	For high impedance recorder, 100 mV for full scale meter deflection.
Batteries	Standard: Remote battery pack containing 16 "C" cells and with a 1 meter cable, designed to be carried on a belt Optional: Internal rechargeable batteries. Three 6 volt, lamp-hour Centralab GC 6101 sealed lead acid cells. 8 hour recharge time
Battery Test	Readable on meter
Battery Charger	110V to 220V AC, 50/60 Hz or 24 to 28V DC supply. Automatic charge rate and cutoff preset for Centralab GC 6101 batteries
Power Consumption	60 milliamperes. GC 6101 batteries rated for 16 hours continuous use. 30 hours of operation with Leclanche type C cells
Tripod	Aluminum. Single shaft with 3 collapsible legs and swivel head which screws easily into base of magnetometer
Optional Remote Sensor	Sensor assembly is installed in a small tube on an 8 meter cable. Internal sensor is automatically eliminated when remote sensor is connected to console
Weights & Dimensions	Standard console 1.7 kg 160 x 70 x 255 mm Standard battery pack 1.2 kg 38 x 140 x 259 mm Console with rechargeable batteries 2.5 kg 160 x 70 x 255 mm Battery charger 1.1 kg 155 x 65 x 65 mm Tripod 1.9 kg, approx. 1 m high
Standard Accessories	Battery pack and cable, batteries, carrying case, carrying strap, manual
Shipping Weight	Approximately 9.5 kg

SCINTREX

222 Snidercroft Road
Concord Ontario Canada
L4K 1B5

Telephone: (416) 669-2280
Cable: Geoscient Toronto
Telex: 06-964570

Geophysical and Geochemical
Instrumentation and Services

DMW GEOPHYSICAL SERVICES, INC.
Authorized Scintrex Representative
4088 West 1820 South, Unit B
Salt Lake City, Utah 84104
(801) 972-4004

SCINTREX MFD-4 Digital Fluxgate Magnetometer

Function

The MFD-4 is a portable, digital-reading fluxgate magnetometer designed for use when vertical component measurements of the magnetic field are desired.

The digital readout allows simple world-wide operation with one gamma resolution without scale changes, when used with the tripod, otherwise, 5-10 gammas. 1 handheld

Features

One gamma resolution anywhere in the world without any range changes or latitude adjustments

200,000 gamma range

Polarity of measured component is automatically shown on digital readout greatly facilitating operation near magnetic equator

Reliable light-emitting diode digital display with complete test feature

Unique no-glare polarized reflector permits easy reading in bright sunlight

Compact, easily operated, internal self-leveling sensor package permits rapid field surveys

Long service from only 4 D cells due to reliable COS/MOS circuit design

Digital readout of battery voltage

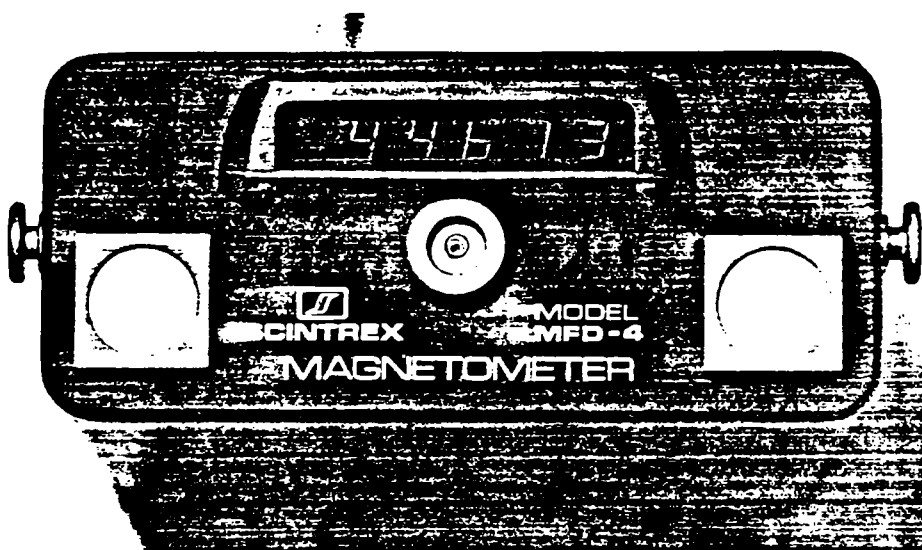
Very low temperature drift

Will measure accurately anywhere, even in presence of steep magnetic gradients

Good power line and ambient noise rejection

Can be used for magnetic susceptibility and remanance measurements by bringing samples near to sensor

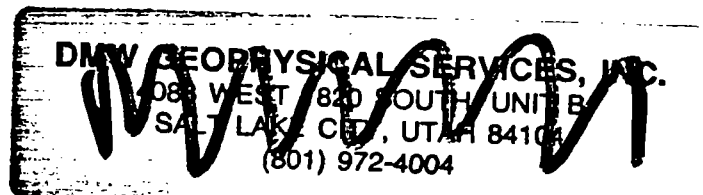
Rugged all metal case for long field life



Technical Description of MFD-4 Digital Fluxgate Magnetometer

Resolution	1 gamma
Measuring Range	-99,999 to +99,999 gammas
Temperature Coefficient	Less than 1 gamma/°C
Magnetic Memory Effect	Less than 1 gamma following exposure to 100,000 gamma field
Measuring Program	First display is lamp test. subsequent magnetic field readings are updated every 2 seconds as long as the ON switch is depressed.
Display	5 digit plus polarity sign; Light Emitting Diodes
Power Source	<p>Remote battery pack containing 4 "D" size carbon-zinc dry cells permits over 2000 measurements (10 seconds each at 1/min. rate) at 25 °C. Designed to be carried on belt with 1 meter cable to magnetometer console.</p> <p>Optional: Remote battery pack containing one 6 volt 6 amp/hour sealed lead acid rechargeable battery permits over 5000 measurements. Designed to be carried on belt with 1 meter cable to magnetometer console. Supplied with automatic cutoff battery charger operating from 110 or 220 volt, 50/60 Hz or 10-14 volt DC supply.</p>
Battery Test	Digital readout of normalized battery voltage activated by touching switch.
Operating Temperature Range	-40°C to +60°C
Tripod	Aluminum, with 3 collapsible legs and swivel head which screws easily into the base of the magnetometer.
Weights and Dimensions	<p>Console: 1.6 kg 160 mm x 70 mm x 265 mm</p> <p>Battery Pack: 0.5 kg 150 mm x 80 mm x 90 mm</p> <p>Tripod: 1.5 kg 130 mm extended length</p> <p>Optional battery pack: 1.5 kg 145 mm x 115 mm x 65 mm</p> <p>Charger: 1.0 kg 155 mm x 65 mm x 65 mm</p>

SCINTREX



Geophysical and Geochemical
Instrumentation and Services